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Structural Features and Age of Gold Ore Deposit Associated With Granitoid Pluton

18650160 Moscow IZVESTIYA AKADEMII NAUK SSSR: SERIYA GEOLOGICHESKAYA in Russian No 6, Jun 88 (manuscript received 16 Oct 86) pp 107-116

[Article by A. M. Zhirnov, USSR Geology Ministry]

[Abstract] A study was made of a gold ore deposit of the vein type situated in a Mesozoic folded region in the exocontact of a granitoid complex. According to existing concepts, it was formed in the Late Jurassic-Early Cretaceous in paragenetic relationship to an unexposed intrusion of dioritic composition and the mentioned granitoid complex of Early Cretaceous age and was metamorphosed under the influence of the latter. The evidence of a pregranitic age of the deposit and the metamorphism of the ores includes micropeculiarities of the quartz structure, the presence of contact-metasomatic (skarn) minerals in the deposit and fragment-like quartz segregations in dikes and granites. An intrusion of granitoid composition, at whose top the deposit was localized, was exposed in the course of subsequent mining work in depth. In a study of the geological interrelationships of gold quartz veins with magmatic rocks there was considerable evidence of intersection of the granitoid intrusion and the dikes and skarns accompanying it by gold quartz veins and veinlets and a metasomatic origin of the fragment-like quartz segregations was determined, evidence of a more recent (Late Lower Cretaceous) age of the deposit. The fact that a more recent age of the gold mineralization relative to the granitoid pluton has been established considerably upgrades the prospects of this deposit with depth because the mineralization is continued both in the granites and in the region as a whole, making it possible to define new sectors suited for gold deposit exploration. It was found that the gold mineralization is formed primarily within the limits of long-lived tectonic blocks intersected by faults oriented in different directions, providing paths for the escape of post-magmatic solutions from the ore- generating hearths. Figures 6; references: 6 Russian.

Research on Some Methods for Retrieving Scalar Field From Random Grid

18650166 IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEODEZIYA I AEROFOTOSYEMKA in Russian No 1, Jan-Feb 88 (manuscript received 14 Apr 87) pp 30-34

[Article by L.O. Babeshko, candidate of technical sciences, Moscow Order of Lenin Institute of Geodetic, Aerial Mapping and Cartographic Engineers, and Nguyen Tkhan Vyet (Socialist Republic of Vietnam)]

[Abstract] The problem often arises of retrieving a function from the results of its measurements at randomly situated points. In modern practice interpolation and approximation by two-dimensional splines are widely used in solving such problems. However, if the number of initial points is thousands or tens of thousands the computational difficulties are simplified by use of the finite elements method. This article is an empirical investigation of the quality of function retrieval by these methods in a specific model. The analytical function of two variables was used as the model. The function was retrieved using specially developed programs. The problem was examined as a global interpolation problem involving solution of a system of n equations. This system has an infinite number of solutions because the number of equations in it is always less than the number of unknowns. Any one solution is found by minimizing a functional which by choice of a suitable operator characterizes the measure of solution quality f. That f function is selected as a solution which ensures a minimum of the quality functional. Proceeding on this basis, solutions are obtained by two methods: interpolation spline and finite elements methods. The results of computations obtained using quality functionals of two types are given. The most precise results were obtained by the interpolation spline method. The best choice of quality functional is indicated. A procedure for increasing the accuracy of the finite elements method is proposed. Unsatisfactory results are obtained by the finite elements method when the volume of initial information is inadequate. The interpolation spline method is recommended when there is an inadequate volume of initial data. Figures 4; references: 5 Russian.

Data Bank in Automated Mapping System

18650170a Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 6, Jun 88 pp 31-34

[Article by S. A. Kadnichanskiy]

[Abstract] Digital terrain models are an important part of the ensemble of processes involved in map compilation and revision and upgraded automation is required for supplying users with mapping information in both digital and graphic form. In an automated system the main role is played by a regional mapping information bank (RMIB) for the centralized accumulation and multiaspect collective use of information. The RMIB supplies necessary information for planning agencies and for automating technological processes for map compilation and revision, producing graphic products and planning work on map compilation and revision. The digital information for the RMIB is obtained by cartometric, photogrammetric and geodetic methods. The most important task in developing the RMIB is the planning of data bases, the most important stage of which is organizing the general logical structure of the data or formulating a conceptual model, which must serve as the basis for future data processing. If the data accumulated in the bank cover an adequately extensive region the totality of digital cartographic information is broken down into archives and data bases. The archives are for long-term data storage. Data bases have direct access and programs are available for their exploitation. A single data base incorporates all available interrelated data, in

accuracy and completeness corresponding to a map of some definite base scale. Since there is need for accumulation of information for topographic maps at different scales it is desirable to form a data base system which in addition to mapping data bases incorporates bases for topogeodetic study of the region and reference information. The overall logical organization of a base of digital cartographic information is illustrated in a block diagram which is used in a detailed description of operation of the base. Figure 1.

Method for Digital Processing of Relief Information

18650170b Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 6, Jun 88 pp 34-37

[Article by R. I. Elman and Ye. D. Bodanskiy]

[Abstract] In the automated solution of mapping problems it is customary to use a screen digital relief model (DRM). With the repeated use of relief information it is desirable that it be stored in data bases. In this case it is more economical that the base not contain a grid model, but the initial contours, represented in vector format, in which case it is called a vector DRM. The All-Union Lesproyekt Association, in developing an automated forest mapping system, has written programs which on the basis of the initial information make it possible to display both screen and vector DRM and from these, retrieve contours in the initial format. The automated forest mapping system includes a scanning microdensimeter, screen display system, minicomputer, screen and vector output devices. The transformation of the initial image to a filled DRM and vice versa, and also into a vector DRM, is accomplished using a display processor. The working procedures are described in detail. The entire process of creating a screen DRM in the size of one display frame, including the input of contours and interactive procedures, requires 27 minutes. The time required for forming a vector DRM from the time of coding of contours to the sending of a fragment to the data base is 5-10 minutes. The time required for extracting a fragment of a vector DRM from the data base, preparation of a file for drafting and drafting itself is 10-15 minutes. The memory volume of the display system used for storing a screen DRM is 64 Kbyte, whereas for a vector RDM, obtained from one display frame, it is from 5 to 10 Kbyte. The relief images which are obtained can be used for the interpretation of aerial photographs and space images of forests growing in mountainous areas, in evaluating the accessibility of lumbering areas, in planning cutting and roads for timber removal. Figures 2; references: 8 Russian.

Automated Measurement Outfit Based on 'Priboy' Radiogeodetic System

18650170c Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 6, Jun 88 pp 40-44

[Article by G. G. Pobedinskiy, V. T. Zvyagintsev, V. F. Stroyev (deceased), A. A. Genike, M. I. Vernitskiy and V. V. Zlotin]

[Abstract] Many of the automated measurement systems which have been developed in recent years have excessive size and weight and consume excessive power and require use of specially equipped boats of considerable displacement and are therefore ill-suited for use in internal water bodies and in the coastal zone. A portable automated measurement complex has now been developed on the basis of the "Priboy" radiogeodetic system and the ATOS automated topographic system. A block diagram of this outfit is given. It consists of two main parts: a field measurement-recording complex, carried aboard the measurement ship, and set up at land stations in a horizontal survey base; an outfit for decentralized processing of data, set up at the party field base. The radiogeodetic system operates in the 3-cm range. All system stations operate on storage batteries. The shore equipment is mounted on tripods or masts (a photograph shows the appearance of a shore station). The remote equipment is installed on the deckhouse roof. The analog echo sounder used is of a type employed in rivers and lakes. A block diagram shows the system for decentralized processing of measurement data (its main components are a minicomputer, thermal printer and portable curve plotter). The process is described in detail. Field work was carried out in Rybinskoye Reservoir in August-September 1987 with shore stations positioned in such a way as to ensure surveying of a sector coinciding with a sheet at 1:10 000. The distance between survey lines was 150 m. A total area of 15 km2 was mapped in 24 runs and the coordinates of about 1400 points were determined. The important conclusion is drawn that in most cases the replacement of a continuous profile by discrete values is entirely admissible and does not result in distortions in the representation of underwater relief. In any case the discrete information obtained during measurement work with this system can be supplemented during preliminary processing due to the availability of a simultaneous analog record of echo sounder readings. Figures 4; references: 6 Russian.

Is the Black Sea Dying?

18650010 Moscow IZOBRETATEL I RATSIONALIZATOR in Russian No 7, Jul 88 pp 14-15

[Article by Ya. Massovich]

[Text] A terrible picture was drawn at a conference on the Black Sea at Sevastopol in April 1987. The red algae, the source of biological productivity in the sea and a valuable raw material for industry, have almost completely died out. The colonies of mussels have decreased by 78 percent and the oyster beds are 90 percent less productive. Mackerel, sarda and bluefish have almost disappeared and mullet has decreased by a factor of 100. Nature has seemingly moved backward toward the Protozoa: Noctiluca, plankton choking the entire Black Sea, have increased by a factor of 1000 in the water and the number of coliform bacteria in a liter of water from Odessa Bay has increased by a factor of a million. The number of jellyfish is increasing without restraint. The level of carcinogens has increased by two or three orders of magnitude.

The reason for such a misfortune on the Black Sea shelf in our day of glasnost should be known to all. The newspaper KOMSOMOLETS KUBANI on 21 August 1987 wrote: "The waters of about 70 storm drains, streamlets and drainage canals dump their waters into Gelendzhik Bay. And what about this water? Some of the existing storm drains are clogged with debris, silted up, transformed into rubbish pits... As a result of physical wear and tear on sewer networks and their technical imperfection in many cases the discharge of municipal waters is directly into the bay. And the city purification systems cannot handle the load..."

Today during the spring-summer season, during the period of spawning and biological activity of all organisms, the Black Sea suffers from an insufficiency of fresh water. Its greater part, carried into the sea by small and large rivers, is withdrawn along the way and fills reservoirs. As a result, a "concentration of destructive factors" increases on the shelf; there is nothing to mix or dilute them.

Several years ago the American satellite "Lantac" observed a strange phenomenon: the Dead Sea suddenly changed its color. The reason for the change in color was simple: the Jordan River, flowing into the sea, was made completely dry along its path due to the withdrawal of water for irrigation. As a result, water density at the surface increased and "overturning" occurred. The deep waters emerged at the surface. The Dead Sea doesn't care what is up and what is down. It is dead. And now tragedy threatens the Black Sea water body. And if everything continues as it has, at some time in the future the deep dead waters polluted with hydrogen sulfide will rise to the surface and then...

Agriculture is working hand-in-hand with present-day hydroengineering. Among the thousands of tons of chemical fertilizers and pesticides annually sprayed on fields, only a small part remains in place. Most of it flows into the sea. Organic substances arrive in excess and devour the oxygen which is deficit there.

Such an attack on the body of the sea has left it almost breathless in the shelf zone. Oxygen starvation is increasing in the bottom zone. By the end of summer, due to the slight oxidation of organic matter, hydrogen sulfide contamination of sea water develops here in an avalanche. During periods of stormy winds these zones are displaced shoreward and the water polluted with hydrogen sulfide emerges at the surface. Everything alive dies. The most productive sea regions are unsuitable for fishing.

There is another side of the problem. We take the products of the world ocean and improve the means of exploitation of the sea, but we do not return to it even that little which we give to the soil. The main source of organic matter in the ocean is phytoplankton. This means that it is necessary to encourage the growth of these unicellular plants. Like any green plant, their development requires the sun's rays, carbon dioxide, and finally, fertilizer. Among this triad we have some control only over the latter. A variety of chemical elements, so-called biogenous substances, are dumped into the water here and there where rivers flow into the sea. However, for the time being no one has dared to take such technology into the open sea. The scales are not the same.

But here is something remarkable: the bottom organic matter, polluting the Black Sea shelf with hydrogen sulfide, settling at the deep horizons of the entire world ocean, is an accumulation of biogenous material, the very fertilizer which is lacking for the reproduction of phytoplankton at the sea surface. It lies, so to speak, "right underfoot." Invaluable yields at the sea surface over the millenia, settling in a thick layer on the bottom, are stored in the cold, heavy waters. For the time being they remain inaccessible.

To be sure, one would like to count on the wisdom of power specialists, agricultural directors and industrialists, a growth of their ecological consciousness with respect to the Black Sea. But to hope is to hope and leads nowhere.

At least two problems must be solved in order to maintain life in the Black Sea and raise its productivity: restore the oxygen balance of the bottom layer of the shelf and organize the transport of at least part of the bottom biomass to the surface.

In principle, it is known how to contend with hypoxia (oxygen deficit). In actual practice it is a different matter. It is proposed that oxidants of the sodium nitrate type be introduced into water bodies. But the neutralization of a ton of hydrogen sulfide requires almost three times more oxidant... Attempts are being made to transport the polluted deep waters through pipes. Or to use aeration. Oxygen-poor water is raised to the surface by pumps and is sprayed out by jet equipment... However, none of

these solutions are adequate for the Black Sea shelf with an area of almost 20 000 square kilometers. For the time being no one intends to invest in such an enterprise.

Nature itself has suggested a worthy idea. There are zones in the ocean where the deep waters are raised to the surface by a current, seemingly being transported by themselves. The areas of these so-called natural upwellings are less than 1 percent of the surface of the world ocean. But precisely these regions account for up to 45 percent of the total world catch.

After graduating from the Biological Faculty of Moscow State University, B. P. Pshenichnyy wandered over half the world in different ships. Finally he grew weary of being in the fishing trade, and his wife was tired of it as well. In short, he collected the accumulated scientific material, defended his dissertation and began to work at the All-Union Scientific Research Institute of the Fishing Industry and Oceanography (VNIRO). And then he became fascinated with a fantastic undertaking. He thought up the idea of creating an artificial upwelling, a sort of perpetual apparatus for saving the sea. The idea was given life by carrying out the first experiment in an aquarium. A glass tube, vertically suspended on a float, and waves, that was it. Flying up on a wave crest, the tube also raises a column of fluid upward. At the next moment the float is at the bottom of the wave trough and the water, which is above its level, splashes out of the tube. Thus, time after time, the wave pumps deep water to the surface. The natural pump proved to be so simple that the inventor himself initially even doubted: would the wave pump up bottom water? A layer of glycerin was poured on the bottom and it was dyed with ink. A wave generator was started up and the violet fluid moved upward in the tube. The artificial upwelling was recognized as an invention (Author's Certificate No 1 248 579).

Specialists reacted cautiously and distrustfully to the idea; there was too much to do even without this undertaking. After in situ experiments the sceptics calmed down some. An artificial upwelling near Anapa operated stably at depths up to 200 m. The length of the pipe was limited. With a diameter a little more than a meter, in a 200-m wave each second it can splash up to a cubic meter of deep water onto the surface. A hundred such very simple "pumps" can yield almost three percent of the annual runoff of the Volga. And without any expenditure of energy! The water ejected onto the surface contained several times more biogenous matter. Brown algae, placed in the enriched zone, more than doubled their weight in comparison with control plants. And since the biomass is heavier, it can be raised almost without any admixture of hydrogen sulfide. The upwelling here already this year is increasing the yield of mussels and oysters in the plantations on the Black Sea shelf near Anapa.

Everything went fairly well with a large wave. In small waves it became especially noticeable that part of the water during raising of the pipe nevertheless moved downward and there was a loss in output. Then the inventors covered the end of the pipe with a valve. The pipe moved upward, to the wave crest, and the valve remained tightly seated. Now there was no suction of air from above; the pressure immediately supports the column of fluid and does not allow it to escape from the pipe (Author's Certificate No 1 314 989).

Bays and gulfs differ in that the waves in them are weak even on stormy days. The idea came to transfer the working organ of the pump into the sea, where waves constantly prevail, and to extend the pipes to the contamination zone. However, it was then found that a different procedure can be used. It is necessary that the valve be replaced by a check valve and the wave pump is started up in the opposite direction (downwelling); it begins to pump water from the sea surface into the depths, diluting the "hydrogen sulfide" water there with fresh water. In short, if there is at least even a weak wave it is possible, little by little, gradually, to cure the sea, to saturate the hydrogen sulfide layer with oxygen.

People at rest at resorts along the Black Sea near Anapa sometimes see a strange sight: powerful fountains rising up in the sea. But to the annoyance of the vacationers, no whales are seen here. This same upwelling lifts a jet skyward through funnels. The inventors are thinking of directing these powerful fountains onto the blades of turbines...

Wave pumps have been tested in the White Sea and in the Baltic. Believing in the idea, the Karelrybprom Association joined in the work. It has been proposed that an artificial upwelling and downwelling system be constructed for sanitizing and feeding plantations of mussels on the White Sea shelf. But the plans have remained plans. The people up north did not want to have extra concerns. And that's the way it goes!

We would like VNIRO to join up with the research theme of the Dnepropetrovsk Okeanmash Institute. There work is being done on the idea of raising ferromanganese nodules from an oceanic depth of 5 kilometers. It is possible that the bottom deposits raised to the surface will give rise to a mud spot around the platform which may spread. Here also an artificial downwelling system would be of value. The mud could without difficulty be driven into the deeper layers from the ocean surface.

It seems reasonable to examine the two closely linked problems together. But the USSR State Committee for Science and Technology must yet give its agreement to such cooperation. It would seem that the purification and sanitizing of the sea can become a field of international cooperation under the UNESCO program "Man and the Biosphere." The health of the ocean is the concern of all. But for the time being all work on artificial upwellings is limited to enthusiasm and good will. But if the voice of one man is the voice of no one,

this is all the more true of the sea. To be sure, there is a need for reliable economic calculations relative to all these innovations. But is one man capable of doing everything alone?

B. P. Pshenichnyy proposes that his idea be tested with tuna. In the catching zone the artificial upwelling apparatus raises a concentration of biogenous substances and gives rise to a zone of disturbance at the ocean surface and a temperature drop. Small fishes should be drawn to these enticements, and that means, tuna as well.

Such an upwelling may replace the entire catching strategy. The inventors draw the following promising picture: each seiner will carry wave pumps, position them in the sea area and catch fish with the biogenous bait raised from the depths.

In 1984 and 1987 B. P. Pshenichnyy reported on the work which has been done at the Scientific Council of the All-Union Scientific Research Institute of the Fishing Industry and Oceanography. They listened, discussed and approved. I asked the inventor: "What has changed since 1984?"

"Almost nothing. The very same thoughts migrated from one document to another. And as before, it was no help at all, although no one interferes with the work."

A strange situation is now developing with contract work. However paradoxical it may seem, money for the upwelling is being taken away from Pshenichnyy. And contracts have been made with different departments of institutes. And now things are going so-so. For work under the contracts the scientists at colleges receive a 50 percent increment to their salary. It is clear that under such conditions no one will hurry with the work; the longer the time which elapses, the better is the payoff. The research programs are dragged out for years. And as if it was their own original idea, not from the walls of VNIRO..

At present it is not fashionable to expand the number of personnel, especially scientific. But I believe that at VNIRO there are not many types of work which in the immediate future will yield practical advantage and the main thing for the future is to give some attention to the artificial upwelling. This is all the more true now that science must "feed itself," so to speak, and not, as before, pick the pockets of others...

Spatial-Temporal Variability of Velocity of Sea Currents in Mediterranean Sea Along Lebanon Coast

18650005a Moscow OKEANOLOGIYA in Russian
Vol 28 No 4, Jul-Aug 88 (manuscript received
10 Feb 87, after revision 13 Nov 87) pp 561-570

N. A. Kibar and S. Yu. Sokolov, State Oceanographic Institute, Moscow]

[Abstract] During 1982-1983 a project was carried out to study sea currents near the Lebanon coast. A number of automatic buoy stations were positioned along the coast at two horizons: at the bottom and at the horizon 25 m. Registry of current velocities, water temperature and conductivity was at intervals 10-20 minutes. The mean duration of continuous observations was about 70 days; individual series had a duration up to 140 days. During the winter the nature of water circulation in the coastal region is determined by nonuniformity of the wind field, whereas during summer it is determined by thermohaline factors. A wide range of statistical characteristics was computed. In the subsurface layer the characteristic velocity of currents is 10-15 cm/s and in the bottom layer 3-10 cm/s. During summer the characteristic velocities in the subsurface layer were somewhat greater than during the winter. The maximal velocities attained 35 cm/s. Estimates of the parameters of currents in the time range from several hours to several months are given. Figures 4; references: 8 Russian.

Organic Phosphorus in Pacific Ocean

18650005b Moscow OKEANOLOGIYA in Russian
Vol 28 No 4, Jul-Aug 88 (manuscript received
6 May 86) pp 571-576

[Article by V. V. Sapozhnikov, All-Union Scientific Research Institute of the Fishing Industry and Oceanography, Moscow]

[Abstract] This is a generalization of data on organic phosphorus collected during the last 5 years, supplemented by similar data in the literature collected earlier. A data bank for such information was established containing materials from more than 60 sources. Maps of the distribution of organic phosphorus were plotted for the horizons 0, 25, 50, 75 and 100 m (these maps are reproduced with the text, together with a map showing the distribution of stations in the Pacific Ocean where such determinations were made). The maximal Porg concentrations are at the horizons 25-50 m. The upper maximum of organic phosphorus is attributable to the intensive development of phytoplankton and high rates of decomposition of organic matter. The diurnal variations of organic phosphorus are most clearly expressed there, which in some cases can be used in estimating primary production. The lower maximum is at the upper boundary of the pycnocline and is a result of the passive accumulation of organic suspended matter. In the surface layers the role of organic phosphorus compounds is unusually high. In tropical and subtropical waters the organic phosphorus reserve in the layer 0-50 m frequently exceeds the inorganic phosphorus reserve. In oligotrophic regions where there is an almost complete absence of phosphates in the upper part of the euphotic layer the quantity of primary production is completely dependent on the rate of regeneration of phosphates. By knowing the Porg reserve in the euphotic layer and the time of P cycling it is possible to estimate primary production in the tropics and subtropics forming exclusively due to recycling. Figures 2; references 23: 13 Russian, 10 Western.

Secondary Pollution of Sea by Organic Peroxides

18650005c Moscow OKEANOLOGIYA in Russian Vol 28 No 4, Jul-Aug 88 (manuscript received 19 Jan 87, after revision 11 Aug 87) pp 577-582

[Article by V. F. Mishukov and Ye. A. Sokolov, Pacific Ocean Oceanological Institute, Far Eastern Scientific Center, USSR Academy of Sciences, Vladivostok]

[Abstract] A study was made of processes of photochemical oxidation of petroleum products in surface sea waters. Experimental data and the results of computations indicated that the rates of photochemical and bacterial oxidation of petroleum products in surface waters are close in value. The laboratory apparatus used in the research is described: the light source was two xenon lamps, each with a power 1.5 kW, which in combination with aqueous and glass filters produced a light which in spectral composition was close to sunlight; light in the range 320-450 nm was incident on a petroleum film in 12 accurately thermostated reactors. Various types of surface pollution were investigated. Data collected in the northeastern Atlantic ocean, Mediterranean Sea, Red Sea, Arabian Sea, Indian Ocean and East China Sea were also exploited. It was found that in the process of photochemical oxidation of hydrocarbon films on the water surface there is an accumulation of organic peroxides, resulting in a decrease in film tension and the water evaporation rate and an increase in the rate of spreading of the film along the water surface. The content of peroxides in surface waters of different regions of the world ocean is: oceanic waters 10-7-10-8 mol/liter, surface waters of ports 10-5 mol/liter, petroleum films after 3 hours of sunlight 10-3 mol/liter, petroleum lumps floating on sea surface, 10-2 mol/kg. Figure 1; references 9: 8 Russian, 1 Western.

Morphogenetic Types of Organic Matter in Bottom Sediments of Southeastern Baltic Sea

18650005d Moscow OKEANOLOGIYA in Russian Vol 28 No 4, Jul-Aug 88 (manuscript received 4 Jun 87, after revision 16 Nov 87) pp 583-590

[Article by N. V. Bobyleva and Ye. A. Romankevich, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] The patterns of formation of the main morphogenetic types of organic matter in the bottom sediments of the southeastern part of the Baltic Sea were investigated. Such morphogenetic research considerably broadens the possibilities of chemical methods for the study of organic matter because they make possible a more objective collection of the most representative samples of bottom sediments for their further chemical study, better judgment concerning the genesis of organic matter and the direction of the processes of its diagenetic transformation. The samples of Quaternary bottom sediments (a total of 161 samples) were obtained using a dredge and corer in June-July 1978 on the 26th cruise of the "Akademik Kurchatov." Three morphogenetic types of organic matter were discriminated (allochthonous, autochthonous and organic matter of mixed genesis) and maps of their distribution in the Upper Holocene sediments (0-10 cm) were plotted. The great contribution of allochthonous organic matter causing storage of organic matter of a mixed genesis in sediments over a large part of the studied sea area was established. The areas of autochthonous organic matter in the upper layer of sediments are associated with regions of increased bioproductivity distant from the shore, zones of reduced receipt of terrigenous matter. Allochthonous organic matter occurs in zones of transfer of great masses of fluvial material, erosion of peat deposits and emergence of relict deposits at the surface. This type of organic matter can serve as an indicator of corresponding facies conditions. Sediments of the boreal zone are characterized by mixed and allochthonous types of organic matter; deposits of the preboreal and Pleistocene zones are characterized by an allochthonous type of organic matter, greatly modified in diagenesis. Figures 3; references 17: 10 Russian, 7 Western.

Composition of Ferromanganese and Sulfide Nodules in Baltic Sea Sediments

18650005e Moscow OKEANOLOGIYA in Russian Vol 28 No 4, Jul-Aug 88 (manuscript received 24 Nov 86) pp 613-617

[Article by G. N. Baturin, I. S. Roginskaya, E. Ye. Rakovskiy and V. M. Kuligin, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow; Central Scientific Research Geological Prospecting Institute for Nonferrous and Noble Minerals, USSR Geology Ministry, Moscow]

[Abstract] New data have been obtained on the structure and composition of ferromanganese and sulfide nodules in the Baltic Sea collected in May-June 1984 on the 39th cruise of the "Akademik Kurchatov." The nodules were recovered from dredged samples at five stations in the central and southern parts of the basin. The ferromanganese formations are represented by micro- and macronodules. The micronodules are circular in configuration, 0.5-1.5 mm in diameter, brown in color with a rough and bumpy surface. The macronodules have a rounded, pancake shape, a diameter of 2-4 cm, a thickness 1.2-2 cm, are brownish-black in color with a rough flat surface. Studies with a scanning microscope revealed that the ore matter of the ferromanganese nodules is structureless, whereas the structure of pyrite nodules is crystalline. According to data from chemical, atomic absorption and neutron activation analyses, the ferromanganese nodules have accumulations of Fe and Mn (as well as Mo, Cd, Ag, As, P, Au, Zn) relative to the sediments, whereas in the sulfide nodules there is an accumulation of As and Au, in addition to Fe and S. A table gives details on the chemical composition of the ferromanganese and sulfide nodules. The data show that marine ferromanganese nodules forming on the boundary of oxidative and reducing media concentrate a considerable number of elements with a variable valency and complex migration forms, whereas the sulfide nodules forming in reducing

sediments selectively concentrate only some of the elements having an affinity to sulfur. Figures 2; references 15: 13 Russian, 2 Western.

Composition of Ferromanganese Nodules in North Atlantic Ocean

18650005f Moscow OKEANOLOGIYA in Russian Vol 28, No 4, Jul-Aug 88 (manuscript received 4 Jan 87) pp 618-624

[Article by G. L. Kashintsev, V. N. Svalnov and Z. T. Novikova, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] The results of petrographic study of the nuclei of nodules collected in the north tropical zone of the Atlantic Ocean on the 40th cruise of the "Akademik Kurchatov" in 1984 are outlined. Samples of nodules and sediments were obtained by trawling, coring and dredging at depths 2900-6006 m from the floor of the Guiana Basin, from the slope of the Mid-Atlantic Ridge and from the zone of its transition to the Canary Basin. The elemental-genetic characteristics of the nodules are of the sedimentation ferromanganese (Canary Basin) and ferruginous (Guiana Basin) types. They are enriched with Fe, Co and Pb and are impoverished of Mn, Ni, Cu and Zn. The nuclei of the nodules from the Canary Basin for the most part are represented by peridotites, gabbros, dolerites and metamorphic rocks. The marked predominance of peridotites and gabbros among the fragments is evidence of a considerable amplitude of movement of blocks of the oceanic crust and the emergence of the third and fourth crustal layers at the surface. Research on the nuclei of nodules is a rather effective means for ascertaining crustal structure in regions with smoothed bottom relief. Increased tectonization of rocks on the remote flanks of a mid-oceanic ridge, intensive redeposition of fragmented material and a considerable thickness of the sedimentary mantle are factors making the regions of the flanks of a ridge unpromising for obtaining abundant bedrock material. Under these conditions there is a need for careful study of the nuclei of nodules and edaphogenic deposits, reliable sources of information on rocks making up the oceanic crust and on fault zones on the ocean floor even in those cases when they are not expressed in the relief and are not detected on the basis of geophysical data. Figure 1; references 6; 1 Russian, 5 Western.

Local Variability of Ferromanganese Nodules in Bottom Sector in Eastern Part of Clarion-Clipperton Ore Province

18650005g Moscow OKEANOLOGIYA in Russian Vol 28 No 4, Jul-Aug 88 (manuscript received 5 Feb 87) pp 625-631

[Article by N. S. Skornyakova and V. N. Zaikin, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Exploration of test range K-666 from the "Mstislav Keldysh" yielded important data on the nature of distribution, morphology and composition of ferromanganese nodules. The test range, measuring 1 x 0.8 mile, was situated in the eastern part of the Clarion- Clipperton ore province on the surface of a slightly hilly plain with depths 4085-4170 m. Nineteen dredged samples were recovered. Most of the nodules measured in the range 2-10 cm; at most stations all nodules were generally of the same size. Variations in size were usually accompanied by changes in the morphology of the nodules. The minimal size (cm) was characteristic for spherical nodules, pancake-shaped nodules fall in the range 2-8 cm, discoidal—2.6 cm and ellipsoidal—2.8, usually more than 6 cm. With respect to nature of the surface, internal structure and elemental composition, the nodules can be classified as diagenetic and sedimentation-diagenetic. In chemical composition the nodules have high values of the Mn/Fe and Cu/Ni ratios and high Cu, Ni, Mo and Zn contents. The elemental composition was determined by the atomic absorption method and was compared with data from other expeditions in other parts of the Pacific Ocean. The Fe content in these nodules varied in the range 4.8-7.9 percent, Mn—23.7-29.0 percent and Ni + Cu sum—from 2.03 to 2.56 percent. Variability of nodule productivity, morphology and size is related to instability of near-bottom sedimentation conditions, current fluctuations, sedimentation rates and intensity of accumulation and mixing of the upper semifluid sediment layer. Figures 2; references 9: 6 Russian, 3 Western.

Heat Flow and Geology of Tyrrhenian Sea

18650005h Moscow OKEANOLOGIYA in Russian Vol 28 No 4, Jul-Aug 88 (manuscript received 16 Mar 87) pp 639-643

[Article by Ye. V. Verzhbitskiy, I. M. Sborshchikov and P. P. Shilovskiy, Oceanology Institute imeni P. P. Shirshov, USSR Academy of Sciences, Moscow]

[Abstract] Heat flow data were collected from the floor of the Tyrrhenian Sea during the 12th cruise of the "Vityaz" and were integrated with data obtained in this basin by Italian and French researchers. A map showing the degree of geothermal study of the Tyrrhenian Sea is given, as well as a table of observational data for all stations occupied. The heat flow is greater by a factor of approximately 1.5 than in the western and eastern parts of the Mediterranean Sea, averaging 120 plus or minus 45 mW/m2, indicating a high tectonic activity of the Tyrrhenian region as a whole. Three regions with anomalously high heat flows (150 mW/m2) were discriminated. The Tuscan anomalous zone, in the north, has a maximum associated with a structural rise, whereas in the central basin there are zones of high heat flows over 250 mW/m2 in the neighborhood of underwater volcanoes. The high heat flows in these zones correlate with relatively recent volcanic activity of underwater mountains whose age does not exceed 4 million years. Several runs made across the thermal field between 39 and 42° are discussed in detail. The collected data confirm migration of the region of maximal manifestation of tectonic activity and crustal formation processes in the

Tyrrhenian Sea in the direction of the Calabrian subduction zone. The heat flow distribution is evidence of an initial stage of riftogenesis in the central basin of the Tyrrhenian Sea. Figures 2; references 10; 1 Russian, 9 Western.

Variability of Basic Salt Composition of Coastal Waters in Sea of Japan Coastal Zone (Amur Bay)

18650007 Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 301 No 3, May 88 (manuscript received 11 Jun 87) pp 716-719

[Article by O. V. Shevtsova, V. V. Anikiyev and V. I. Ilichev, academician, Pacific Ocean Oceanological Institute, Far Eastern Department, USSR Academy of Sciences, Vladivostok]

[Abstract] In the open ocean there is a constancy of the basic salt composition and an invariability of ion-chlorine ratios. Since other factors are operative in coastal regions, this article discusses the possible scales of vertical-temporal variability of the basic salt composition in a coastal zone. The investigated areas were several parts of Amur Bay which to different degrees are subject to the influence of factors favoring the destruction of constancy of the basic salt composition. The work was done at three 24-hour stations in the summer of 1984. Chlorinity (Cl), salinity (S) and the ion concentration (I) were determined at intervals from 2.5 to 6 hours. The mean daily basic salt composition at all three stations was virtually identical. The factors responsible for local differences are analyzed. Comparison of data on vertical-temporal variability in one of the embayments, in the middle part and in the mouth zone of the bay revealed that in the coastal zone with S = 22-33o/oo there are both spatial and intradiurnal variations of the ion-chlorine ratios. All the studied regions have a low or zero Na/Cl variability and high Ca/Cl variability, but for the first two regions, anomalously high SO4/Cl variations. A constancy of the basic salt composition was observed only for Na and Mg in the middle part of the bay and for Na, K and SO4 in the coastal zone during stormy weather. References 11; 8 Russian, 3 Western.

Some Results of Four-Dimensional Analysis of Hydrophysical Fields in Tropical Atlantic

18650006f Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 7, Jul 88 (manuscript received 21 Apr 87) pp 744-752

[Article by V. V. Knysh, V. A. Moiseyenko and V. V. Chernov, Marine Hydrophysics Institute, Ukrainian Academy of Sciences]

[Abstract] Research in a large-scale transoceanic test range taking in the northern part of the equatorial Atlantic from the shores of Africa to the shores of South America was initiated in 1986. Two large- scale test range surveys were made: in spring and in summer-autumn. STD soundings were made with intervals of 1.5 and 0.5° respectively. Using these materials, this article gives the results of a four-dimensional analysis of hydrophysical fields in this region carried out on the basis of a quasigeostrophic dynamic-stochastic model with the assimilation of temperature and salinity data during the two mentioned seasons. In the studied area (2.5-12.5°N, 15.5-55.5°W measurements were made at 16 horizons (from the surface to 4000 m); the time interval was 24 hours. The four-dimensional analysis method is outlined and representative results are presented. The results were processed on a shipboard computer. The described processing method can be used instead of the dynamic method. Its merit is the possibility of correct allowance for the time when the measurements are made and a thorough analysis of different hydrophysical fields. The results make it possible to judge the spatial and temporal distribution of hydrophysical parameters and can be used in evaluating components of the oceanic energy budget and in study of the variability of heat transport by the system of oceanic currents. Figures 4; references 10; 8 Russian, 2 Western.

Influence of Fine Structure of Velocity Field in Ocean on Propagation of Internal Waves

18650006g Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 7, Jul 88 (manuscript received 9 Feb 87, after revision 3 Aug 87) pp 753-763

[Article by L. A. Ostrovskiy and Yu. I. Troitskaya, Applied Physics Institute, USSR Academy of Sciences]

[Abstract] A fine structure of currents in which the Richardson numbers, determined from the local shear and stratification are less than 1/4, has been discovered in the Atlantic, Pacific and Indian Oceans. In the fine structure of currents the velocity field is a random function of the vertical coordinate z and therefore for describing internal waves propagating against its background it is necessary to use statistical averaging in some form. Various special cases have been examined in the literature. This article outlines a new model describing the influence of the random fine structure of currents on the propagation of internal waves. This model is based on an approximation in which the random components of the fields of displacement and pressure in the wave are small in comparison with the means so that there is a predominance of field components which are large scale in comparison with the fine structure scale. It is shown that stable random currents, even with a zero mean, exert a substantial influence on the dispersion characteristics of internal waves. This model makes it possible to compute the rate of growth or attenuation of internal waves having critical layers with small values of the Richardson number, depending on the properties of the probability distribution function for velocities in the fine structure of currents. The relationship between this model and the kinetic approach to solution of such problems developed earlier is discussed. Figures 2; references 24: 18 Russian, 6 Western.

Radiation of Internal Waves by Regions of Small-Scale Turbulence

18650006h Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 7, Jul 88 (manuscript received 20 Feb 87) pp 764-770

[Article by B. A. Malomed, Oceanology Institute, USSR Academy of Sciences]

[Abstract] A study was made of the radiation of internal waves generated by a turbulent source in the case of equilibrium stratification described by a smooth dependence of the Vaisala-Brunt frequency on the vertical coordinate (for example, in the case of a homogeneous stratification, which corresponds to a frequency not dependent on the coordinate). The examination is based on the theory of perturbations, formulated in terms of Hamiltonian formalism, which is regarded as most natural for solution of the considered problem. Such an approach was used earlier in solving the problem of radiation of sound by turbulent pulsations of a slightly compressible fluid (V. S. Lvov, et al., ZhETF, Vol 74, No 4, pp 1445-1457, 1978). The spectral density of the radiation power of internal waves generated by a turbulent region is computed in general form under the condition that the characteristic lengths and periods of these waves are much greater than the characteristic spatial and temporal scales of turbulent movements. For the special case of homogeneous fluid stratification the radiation power is proportional to the fourth power of the Vaisala frequency and is dependent only on the angle between the direction of radiation and the horizontal plane. References 9: 6 Russian, 3 Western.

Theory and Methods for Computing Distances to Hydroacoustic Beacons

18650128a Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEODEZIYA I AEROFOTOSYEMKA in Russian No 6, Nov-Dec 87 (manuscript received 2 Jun 86) pp 27-32

[Article by V.A. Kougiya, professor, doctor of technical sciences, Leningrad Order of Lenin and Order of the October Revolution Institute of Railroad Transportation Engineers imeni Akademika V.I. Obraztsov]

[Abstract] The coordinates of ships are usually ascertained by determining the distance to hydroacoustic beacons by measuring the time of signal propagation from the ship and back. However, the speed of sound at different depths varies due to change in temperature, pressure and salinity. The inconsistent curvature of acoustic rays gives rise to difficulties in determining distance. In order to facilitate and improve such determinations it is proposed that the signal trajectory slope at the radiation point or the ray parameter be stipulated and that data on the speed of sound distribution be used in computing the required elements of the selected trajectory (horizontal and vertical projections, slant distance and signal propagation time). The trajectory elements are computed by parts, separately for each layer, and the results are summed. Special cases arise and these are examined in detail. The method fully meets the required accuracy. In most cases the error in computing distance is hundredths of a meter and only in the case of complex trajectories is the error tenths of a meter. Time expenditures in computing the correction are minimal. If distances must be computed with a higher accuracy it is necessary to have recourse to successive approximation; in this case an approximation method with a fixed time is more effective. References: 2 Russian.

Evaluating Accuracy of Aerial Photograph Rectification

18650128b Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEODEZIYA I AEROFOTOSYEMKA in Russian No 6, Nov-Dec 87 (manuscript received 18 Mar 87) pp 84-89

[Article by R. P. Ovsyannikov, professor, candidate of technical sciences, Moscow Order of Lenin Institute of Geodetic, Aerial Mapping and Cartographic Engineers]

[Abstract] The accuracy in rectification of aerial photographs is dependent on the characteristics of the initial photographs, the accuracy in determining the plane position of the rectification points, rises of terrain points and on other conditions. The article gives the derivation of the formulas required for taking these factors into account and cites examples of their use, together with an evaluation of their accuracy. The formulas characterizing rectification accuracy are derived using equations describing the process. Examples are given showing the possibilities of a priori evaluation of rectification conditions and assembly of photographs. The practical use of these formulas is much broader. They can be used in evaluating the influence of curvature of the Earth's surface on the geometrical properties of the rectified photograph, for clarifying the conditions under which rectification can be accomplished with the required accuracy from contour points on a topographic map, and for solving many other problems. Figure 1.

Predicting Contrast of Aerospace Image

18650128c Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEODEZIYA I AEROFOTOSYEMKA in Russian No 6, Nov-Dec 87 (manuscript received 27 Apr 87) pp 89-95

[Article by V. N. Ovechkin, candidate of technical sciences, and I. V. Almazov, docent, candidate of technical sciences, Moscow Order of Lenin Institute of Geodetic, Aerial Mapping and Cartographic Engineers]

[Abstract] Contrast is the most important test of the quality of an aerospace image because interpretation requires that there be sufficient contrast against the background. Image contrast is dependent on the reflective properties of surveyed features, characteristics of the

radiation detectors used, camera parameters, registered spectral range, atmospheric conditions and other factors. Taking into account that reflective properties have been determined for a wide range of natural features, an effort was made to predict image quality using the contrast test and on this basis to select the radiation detectors, light filter and time for the survey for which the contrasts of the registered features would be maximal. The problem is solved by the derivation of formulas which take these factors into account. These formulas can be adapted for different aerospace survey conditions. References: 4 Russian.

Allowance for Wind Wave Parameters in Remote Sea Surface Research

18650128d Moscow IZVESTIYA VYSSHIKH UCHEBNYKH ZAVEDENIY: GEODEZIYA I AEROFOTOSYEMKA in Russian No 6, Nov-Dec 87 (manuscript received 6 Mar 87) pp 95-104

[Article by I. I. Strizhkin, docent, candidate of technical sciences, Moscow Order of Lenin Institute of Geodetic, Aerial Mapping and Cartographic Engineers]

[Abstract] Existing methods for predicting waves make it possible to evaluate only the general form of the energy spectrum of waves and the frequency of its maximum as a function of wind speed. However, they do not make it possible to predict the frequency structure of the wave spectrum as a function of wind speed. For solving this problem experimental data were used in developing a method for computing the spectral structure of sea wind waves for any wind speed and features of its use in the interpretation of remote sounding data are presented. Experimental data on wind waves were obtained by their synchronous registry using a photographic survey and string wave recorders from a platform in the Caspian Sea for the wave length range 0.5-80 m and wind speeds 2.5-17 m/s. Wind speed was registered at a height of 13-14 m. The survey was made with two synchronized aerial cameras at a height of 12 m. The survey scale was 1:160. Formulas are derived for computing the frequency components of the wind wave spectrum. The proposed method makes it possible to explain evolution of the wind wave spectrum as a function of change in wind speed and fetch. Comparison of theoretical and experimental data gave a discrepancy of about 10 percent. The frequency makeup of the wave spectrum can be computed only for developing and well-developed waves and the main (resonance) wave system; estimates for more complex cases, such as attenuating or mixed waves, are much more difficult. The method can be used in solving certain inverse problems, such as estimating wind speed in the near-water layer using data from remote records of waves and estimating the frequency makeup of the high- frequency part of the wave spectrum using data on its low-frequency part obtained from space vehicles. Figures 2; references 11: 10 Russian, 1 Western.

Shipboard Remote Laser Monitoring of Organic Matter in Sea Water

18650161a Moscow METEOROLOGIYA I GIDROLOGIYA in Russian No 6, Jun 88 (manuscript received 19 May 87) pp 62-70

[Article by A. A. Demidov and A. M. Chekalyuk, candidates of physical and mathematical sciences, T. V. Lapshenkova, and V. V. Fadeyev, doctor of physical and mathematical sciences, Moscow State University]

[Abstract] The principles of a method for remote laser monitoring of the fluorescent fields of phytoplankton and dissolved organic matter are outlined. The automated apparatus used in remote sensing is described. The lidar employed consists of two pulsed laser sources, an optical system (illustrated in a diagram), an optical multichannel analyzer and a microcomputer, all set up in the ship's laboratory. Sensing radiation is sent out and returned through a porthole and use is made of a rotating mirror with a titanium coating attached to a bulkhead. A full measurement cycle requires 1.5 minutes; with the ship moving at 10 knots this gives a spatial resolution of 450 m. The lidar has automatic and semiautomatic operation modes. The article gives specific results of such work (in the form of maps of the distribution of the intensity of phytoplankton fluorescence) done on a number of scientific research ships in the Black Sea, Baltic Sea and Atlantic Ocean during the period 1980-1986. Various aspects of the spatial and temporal variability of fields registered at different scales are discussed. Laser sounding can be used for joint research on the dynamics of biological and ecological processes and monitoring of their temporal change under the influence of various factors. Figures 4; references: 12 Russian.

Analytical Approximation of Frequency Spectrum of Wind Waves

18650161b Moscow METEOROLOGIYA I GIDROLOGIYA in Russian No 6, Jun 88 (manuscript received 27 May 87) pp 80-87

[Article by I. P. Trubkin, candidate of physical and mathematical sciences, State Oceanographic Institute]

[Abstract] The models of spectra of wind waves now available correspond to present needs to only a certain extent. The Pierson- Moskowitz model has a simple and convenient form but does not always describe the experimentally observed spectrum with a sufficient degree of accuracy. The approximation obtained in the JONSWAP experiment agrees better with measurement data but its form is complex for analytical transformations, limiting the use of this model only to problems with numerical computations. As a partial remedy for this situation, in this article a four-parameter analytical expression is derived for the frequency spectrum within the framework of the known approach, with allowance for normalizing conditions but without the traditional limitation on width of the frequency band of the initial

process. This expression is in the form of the product of power law and exponential functions. It was found that with a suitable choice of parameters this expression makes it possible to describe most experimentally observed, varying in form, evaluations of the frequency spectrum of sea wind waves. With allowance for the equilibrium sector present in the wave spectrum it was possible to determine the correlations between the parameters of the considered approximation of interest for practical applications. Figures 2; references 13: 12 Russian, 1 Western.

Features of Foam Distribution on Sea Surface

18650169c Moscow METEOROLOGIYA I GIDROLOGIYA in Russian No 7, Jul 88 (manuscript received 13 Jul 87) pp 92-97

[Article by I. I. Strizhkin, Moscow Institute of Geodetic, Aerial Mapping and Cartographic Engineers]

[Abstract] Experimental research on foam formation on the sea surface was carried out by a photographic survey at a scale 1:160 from a fixed base in the Caspian Sea. Near-vertical stereo- and monosurveys were made using two aerial cameras. Each photograph covered an area of about 900 m2. A total of 450 photographs were processed for situations with wind speeds 2.7-17 m/s (140 of which were for storm conditions with waves up to 6 m). This made possible an accurate description of the spatial and temporal characteristics of foam formations. The most important of these characteristics is the dependence of the foam cover on the nature of waves at the time preceding registry. For well- developed and almost well-developed waves it was possible to determine the dependence of the relative area of the foam cover P on wind speed v: $P = 0.0033v3$. Comparison of data on foam formation obtained by a photosurvey requires that different factors be taken into account: type of carrier (aircraft, ship, fixed base), type of survey (near-vertical, oblique), type of camera (topographic, ordinary) and survey scale. An aerial survey makes it possible to evaluate the distribution of foam over great areas. The minimal size of the foam formations registered on the photograph is dependent on the survey scale. With an increase in survey altitude information on fine crest foam and fine band foam is lost. Since such a survey is made with a moving camera it is difficult to trace the dynamics of some foam formations. In oblique surveys from ships and fixed bases there is a great loss of information and such surveys are ill-suited for precise measurements. However, a near- vertical survey from a fixed base gives a large image scale and makes possible a detailed study of foam formation processes. Such a survey covers a smaller area than an aerial survey, but this can be compensated by an increase in the number of photographs. Figure 1; references: 6 Russian.

Motions of Stabilized Buoys in Irregular Waves

18650169d Moscow METEOROLOGIYA I GIDROLOGIYA in Russian No 7, Jul 88 (manuscript received 26 May 87) pp 119-126

[Article by V. B. Vaysband, candidate of technical sciences, Southern Division, Oceanology Institute]

[Abstract] All the principal types of motion of a stabilized buoy can be described by linear differential equations with constant coefficients. A rolling stabilized buoy can therefore be regarded as a linear dynamic system which is under the influence of irregular waves. The dynamic parameters of such a system can be determined by a transfer function which characterizes the finite reaction of such a system to waves. Taking the difficulties and shortcomings of traditional approaches into account, the article describes the need for a spectral approach to research on the motions of stabilized buoys in irregular waves. The mechanism of angular motions of a stabilized buoy in waves is described. Analytical expressions are given for the approximate computation of the amplitudes of vertical and angular oscillations of buoys, taking into account the forces damping these oscillations. A specific example is used in examining a spectral evaluation of the vertical and angular oscillations of a buoy in irregular waves for a mean wave height of 1.5 m and a mean period 5.0 s. Figures 2; references: 10 Russian.

Proposal for Modifying Earth's Climate

18650002 Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 27 Jul 88 p 4

[Article by M. Okunev and I. Slobodyan: "When the Desert Advances"]

[Text] Four hundred people in China have died of heat stroke. Crops have suffered over an area of 20 million hectares. An unprecedented drought has affected the United States and the heat is not abating. It is 47° in Greece and up to 30° in Moscow. At the same time, Bangladesh, Vietnam and India are suffering from unceasing rains. Waters are inundating the region along the Amur, Leningrad and Odessa. These are only some of the communications published during the last month. What is going on with the weather? As if in revolt, it is putting the endurance of mankind to the test. Some regions of the Earth are suffocating from the heat, whereas others are drowning in rains and floods.

In the opinion of Ukrainian scientists, all these radical changes can be explained by linking them to the number of neutrinos: elementary particles arriving at the Earth from space.

What relation do neutrinos have to events on the Earth? Very direct. Experiments carried out in different countries have shown that an extremely meager flux of these particles is incident on our planet. But they are companions of a thermonuclear reaction transpiring in the depths of the sun. And since there are few particles, it is logical to assume that our space reactor is weak. And for the most part it is not heating our sun. So what of it?

Academician V. Ambartsumyan feels that in the nucleus of each star matter has been conserved from the time of the prestellar Big Bang. In the opinion of M. Muradyan, doctor of physical and mathematical sciences, it consists primarily of mesons. And the process of their transformation into hydrogen is the main source of solar radiation. The American scientist R. Davis assumes that the role of thermonuclear synthesis in the production of heat in the sun is small. In his work he registered only a third of the flux of solar neutrinos predicted by the traditional star structure models. But mesons, indeed, are becoming fewer and fewer. They are "burned up," like logs, when thrust into our space furnace. The diameter of the sun is decreasing. The intensity of radiation will also drop off.

Now approximately 1.35 KW of solar power is incident on each square meter of the atmospheric envelope. A hundred years ago this quantity was 1 percent greater. Even such a small deviation can be detected, for example, from annual tree rings. If simple extrapolation is carried out it is found that a thousand years ago the intensity of solar radiation exceeded that of today by 10 percent. At that time the Vikings could colonize Greenland. They even cultivated grapes in the new lands. Millions of years before our era tropical forests grew in Antarctica and on Spitzbergen.

But here is a paradox: ten thousand years ago, when the sun was twice as strong as now, a green savanna grew, copious rivers flowed and numerous tribes of hunters lived in the center of the Sahara. And it would seem that the hotter the sun, the hotter the Sahara Desert should be.

But the correlation between the sun and the Earth's climate is not so simple. There is an important link in this correlation which interferes with the logic of this reasoning. This is moisture. Water vapor absorbs light rays and reradiates them in the thermal range; they heat the atmosphere and soil. The greater the moisture, the farther it travels into regions with a continental climate, into the depth of the continents. And there is more moisture in the atmosphere when the sun shines more brightly. Here we have the explanation of the Sahara paradox: earlier the hotter sun heated ocean waters more strongly and evaporated its waters more intensively. These waters, falling as rain, brought life to the desert. But what is occurring now? The intensity of radiation has decreased and there is now less moisture in the atmosphere. The clouds no longer have the power to transport it into the depth of the continents. Condensing at nighttime, the water falls in abundant rains in the coastal regions. The proof is the Caspian Sea phenomenon. Its level began to rise by approximately 10 cm per year. Why? There are many explanations and hypotheses, but in our opinion the reason is that the sun has cooled. A large part of the evaporating water, which earlier was transported through other regions, is now rapidly returned to the sea as rain. Abundant precipitation has also became more frequent on the Black Sea coast. It is only necessary to recall the recent catastrophic snowfalls in Georgia. We note that it has become hotter in the central regions.

Still worse, due to the climatic change fertile lands are suffering; some are becoming swampy, whereas others are becoming dessicated. This process did not just begin. History shows that over the course of several years the fields of the ancient Indians of the Yucatan were transformed into impassable swamps. At this time on the other side of the Earth the inhabitants of Central Asia abandoned their cities, incapable of contending with the advancing sands. Our generation has also not been ensured against something similar.

Elementary computations show that if the intensity of radiation drops off by another one percent the deserts, on the one hand, and the permafrost and swamps, on the other, will threaten to put up to 20 percent of the lands out of agricultural production. And the fertility of the remaining lands will drop off. If events begin to develop in the way we predict, it is scarcely possible to expect favorable conditions in our country. On the contrary, our situation may grow worse. Most of the grain crops in the country are cultivated in regions with a distinctly

continental climate. The moisture falling on the fields for the most part has been evaporated from the Pacific and Indian Oceans. The less moisture there is, the worse will the climate become. Crop cultivation will become increasingly more difficult.

Many scientists are now presenting arguments supporting a global warming. We, however, would like to bring attention to the possibility of a different scenario. In our opinion, the "greenhouse effect" is not capable of compensating for the decrease in solar heat. And since a cooling is not precluded, it is necessary to think a little about how to prevent it. There is a method. and it is not so fantastic as it may seem at first glance.

It is difficult to drain swamps by traditional methods and it is still more difficult to contend with droughts. By irrigating the deserts we reap only an extremely modest effect, lose water and salinize the soil. But possibly it is not necessary to expend billions on ecologically dangerous canals and on reversing the courses of rivers, but instead try to change from local to global methods. How about simply trying to heat some sectors of the Earth and evaporate water from others, adding the lost moisture to the atmosphere? And it will again come down as beneficial rain in arid regions.

We propose to assist the cooling sun. Recall the projects whose authors have wanted to put satellites with gigantic elastic mirrors into a geostationary orbit. And...launch the "reflectors" into predetermined positions. The reflected energy will replenish the heat losses. The energy increment can be extremely impressive. And by adding to the area of the mirrors it is possible to compensate the decrease in solar radiation.

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Determining the Coordinates of Astronomical Objects by Means of an Optical-Television System and a General-Purpose Computer

18650003 Ashkhabad IZVESTIYA AKADEMII NAUK TURKMENSKOY SSR: SERIYA FIZIKO-TEKHNICHESKIKH, KHIMICHESKIKH I GEOLOGICHESKIKH NAUK in Russian
No 3, May-Jun 88 p 83

[Article by A. Sh. Atayev, S. Mukhamednazarov, and N. A. Tarasova of the Fizio-Technical Institute of the Academy of Sciences of the Turkmen SSR]

[Text] Nowadays optical-television systems, in combination with general-purpose computers, are being used more and more in astronomical position observations. This is due to the effort that is being made to determine the coordinates of astronomical objects in a timely fashion and with high precision.

The observatory of the Fiziko-Technical Institute of the Academy of Sciences of the Turkmen SSR (Vanovskiy) has an optical-television system which is based on an AZT-7 telescope. This system makes it possible to observe and measure the coordinates of such astronomical objects as planets, asteroids, and stars with a brightness of up to 14. The processing of the observations and the evaluation of the precision of the results obtained are done on the observatory's "Ekran-4" computer system.

Observation and processing procedure: the procedure for determining the coordinates of astronomical objects is based on the idea of using a special test grid, which is projected onto the screen of the television system[1]. During the observations the test grid, the object under examination and the reference stars (i.e., stars with known coordinates) appear on the screen of the optical-television system. By recording the instants when the object and the reference stars intersect the coordinate lines of the test grid, we obtain enough information to unambiguously determine the coordinates of the astronomical objects using the methods of photographic astronomy[2]. The use of the test grid also makes it possible to take the distortion of the optical-television system into account.

In writing the software, use was made of the algorithms developed by V. S. Melkumov[1], which make it possible to determine the equatorial coordinates of both astronomical objects that are stationary relative to the stars and of those that are moving across the sky. Special algorithms for rejecting erroneous measurements were also used in compiling the programs.

The processing of the observations is done in four stages: inputting of the data into the computer; the actual processing (rejection of initial data, the computations, and the linearity check of the preliminary and final results); the identification of the information needed for the non-linear check; the checking of the results to ensure that the coordinates are a quadratic function of time.

The first two stages are carried out using different programs for the stationary and the moving objects since they are observed using different methods, while the last two steps are carried out using common programs.

A linearity check indicates that the parameters being measured are expected to be a linear function of time. The permissible limit of deviations from a linear dependency is specified in advance. The computer rejects initial data or computation results which do not fit within the specific limit. The errors are caused by inattentativeness on the part of the operator during the observation or while inputting the information into the computer and by misidentification of the reference stars. The quadraticity check performs the same rejection function; however, the deviations are calculated not from a straight line, but rather from a parabola.

The results of the computation are presented in the form of a table, which indicates the unconditioned initial data, some of the equipment parameters, the equatorial coordinates of the astronomical objects at the time the

measurements were made and the results of the statistical process of the information obtained. Over the course of the year, the results of the work can be used to assess the mean precision with which the coordinates of astronomical objects are determined at our observation facility. This precision is approximately 10 seconds of an arc.

The processing programs are written in Fortran and Pascal. They work in the RAFOS operating system on the "Elektronika-100-25" computer.

Conclusions

Software has been developed for determining the equatorial coordinates of astronomical objects. The advantage of these programs is the convenience of inputting the information into the computer, the fact that there is a way of rejecting substandard data, and the statistical analysis of the results obtained.

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Inverse Problem of Transionospheric Sounding

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol 28 No 4, Jul-Aug 88 (manuscript received 14 Apr 87) pp 625-631

[Article by V. Ye. Kunitsyn, A. B. Levashov and A. P. Matveyev, Moscow State University]

[Abstract] The electron concentration profile in the inner ionosphere has usually been retrieved from external sounding ionograms and transionograms. The reception of transionospheric signals can be by either a receiver on the ground or a receiver on an artificial satellite after signal reflection from the Earth's surface. The latter variant makes it possible in one revolution around the Earth to obtain a section of the global distribution of electron concentration. In some earlier studies a model approach to this problem was used in which a definite electron concentration profile model was employed and experimental data were used in determining the parameters of the model either directly from a system of nonlinear equations or by minimizing the functional of nonclosures of group paths, either measured or computed for a stipulated model profile. A different and more effective approach has been proposed for nonmodel solution of the inverse problem of ionospheric sounding and for finding an explicit inversion of the initial integral equation. The solution is represented in the form of a Fourier series in a system of specially selected orthogonal polynomials. The pertinent algorithm is outlined. It is shown that this solution makes it possible to take into account a priori geophysical information on the form of the profile. The influence of errors in measuring group delays on the procedure of profile retrieval is examined. Numerical experiments were carried out which illustrate profile retrieval by this method. Figure 1; references 14; 9 Russian, 5 Western.

Determining Transport Paths of Anthropogenic Aerosol Into Northern Regions

18650006a Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 7, Jul 88 (manuscript received 23 Jun 87) pp 680-686

[Article by A. A. Vinogradova, I. P. Malkov, B. I. Nazarov and A. V. Polissar, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] The paths of transport of anthropogenic aerosol into the northern regions of the USSR were determined using data on the elemental composition of individual aerosol samples and the results of a synoptic analysis of the movement of air masses. The samples were taken on Severnaya Zemlya and on Wrangel Island in the spring of 1985 by pumping surface air through filters for 1-2 days. The content of different elements was determined by the neutron activation method and then scaled to the concentrations of the corresponding elements in the surface air at the sampling points. The mean concentrations of 21 elements and the first conclusions drawn on the basis of these measurements were given by the authors in IZV. AN SSSR: FAO, Vol 23, No 5, pp 519-524, 1987. After describing the methods employed, the results of synoptic and elemental analysis are reviewed and a list of the probable sources of aerosol pollution are given for 10 specific cases. Among the considered samples, in two cases the origin of the aerosol was anthropogenic effluent from Europe and Great Britain, three samples were of North American origin and in five cases the aerosol was from sources in the USSR. Figure 2; references 11: 2 Russian, 9 Western.

Variations in Total NO2 Content Over Polar Urals Determined From Aircraft Observations

18650006b Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 7, Jul 88 (manuscript received 25 Jun 87) pp 687-694

[Article by A. S. Yelokhov, A. N. Gruzdev and N. F. Yelanskiy, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] The results of aircraft measurements of variations of the total content of NO2, ozone concentration and temperature over the Polar Urals are given. The

flights were made from Pechora to Saranpaul in an IL-14 aircraft laboratory (flight speed 3.5-4 km/min, flight altitude 3.0-4.5 km). The flight path was laid out virtually perpendicular to the Ural range. NO2 measurements were made using a special spectrophotometer. the NO2 content was determined by two methods: using the spectra of direct solar radiation and the spectra of radiation scattered at the zenith. The first method gives the total NO2 content in a vertical column, and the second the NO2 content in the atmosphere above the layer of effective scattering, which with approach of the solar zenith angle to 90° is displaced from the lower troposphere into the tropopause region. The NO2 content was computed using 5 wavelengths in the spectral range 430-445 nm. The ozone concentration at the flight level was measured using an electrochemical cell. Meteorological factors were taken into account. Wavelike variations whose amplitude attained 50-70 percent of the mean value were detected; the "wave length" was 20-25 km. In the troposphere lee waves with a wave length 10-13 km were observed on individual days. However, the interpretation of data from observations made on the basis of photochemical modeling do not make it possible to relate the detected NO2 fluctuations to orographic processes. Determination of possible orographic effects in the total NO2 content requires the continuation of observations, including measurements of direct and scattered solar radiation, which must also be accompanied by measurements of the total ozone content. Figures 2; references 24: 11 Russian, 13 Western.

Integral Characteristics of Light Scattering by Large Spherical Particles

18650006c Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 7, Jul 88 (manuscript received 28 Jul 86) pp 695-701

[Article by E. P. Zege and A. A. Kokhanovskiy, Physics Institute, Belorussian Academy of Sciences]

[Abstract] Analytical relationships between the characteristics of radiation fields, on the one hand, and the parameters of microstructure of scattering media and the optical constants of the matter of scattering particles, on the other, are needed for solving problems in atmospheric optics, radiative transfer and various technical problems. In approximate methods for computing radiation fields under multiple scattering conditions it is necessary to stipulate only some integral characteristics of scattering by an elementary volume. In the theory of transfer in slightly absorbing thick layers such parameters are the extinction index, probability of survival of a photon and mean cosine of the scattering indicatrix. This article gives the derivation of approximate formulas for these scattering characteristics in polydisperse formations of large spherical particles. These formulas are applicable in a wide range of change in size and optical constants of the matter in such particles. These formulas relate the cross section and mean cosine of the scattering indicatrix and the parameters of microstructure and the complex refractive index of matter in the disperse phase. The examination is made within the framework of ray optics. Edge effects are taken into account in determining the mean cosine. Comparison with the Mie theory indicated a high accuracy of the derived formulas for large spherical particles. Figure 2; references 13: 8 Russian, 5 Western.

Determining Scattering Indicatrix From Results of Measurements of Scattered Radiation

18650006d Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 7, Jul 88 (manuscript received 27 Apr 87, after revision 30 Oct 87) pp 702-710

[Article by O. A. Avaste and Yu. V. Knyazikhin, Tartu State University]

[Abstract] Many studies have been devoted to determination of the scattering indicatrix on the basis of radiation intensity measurements. These are reviewed and the inadequacies of the various methods are pointed out. In order to eliminate these inadequacies a new method is proposed for solving the inverse problem of determining the scattering indicatrix at a particular point in the atmosphere from the angular distribution of scattered radiation at this point. The initial data used in the method are: optical depth at which the measurements are made; single scattering albedo; coordinates of the unit direction of solar radiation; angular distribution of scattered radiation at this point. A case when the intensity of multiply scattered radiation incident at this point is comparable to single scattering is examined. This problem is solved by the reduction of the integrodifferential transfer equation to an integral equation of the second kind relative to the sought-for indicatrix on the basis of linear transformation of the Cartesian coordinate system used in reckoning directions. Information on the underlying surface is not used in solving this equation. The results of a numerical investigation of this problem are given. Figures 4; references 16: 15 Russian, 1 Western.

Explosive Generation of Surface Waves by Wind

18650006e Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 7, Jul 88 (manuscript received 23 Jun 87) pp 723-734

[Article by N. N. Romanova and V. I. Shrira, Atmospheric Physics Institute, USSR Academy of Sciences, and Oceanology Institute, USSR Academy of Sciences]

[Abstract] A new nonlinear mechanism (in the context of wave generation by the wind) is proposed: the "explosive" generation of wind waves. The term "explosive" generation is used for designating a definite type of instability whose initial stages are characterized by exceedingly rapid growth. This type of instability, caused by resonance

interaction of waves of different energy signs, is encountered in different hydrodynamic situations. The article outlines the range of qualitative effects applicable to the problem of generation of wind waves caused by the explosive generation mechanism and gives their quantitative description within the framework of a very simple hydrodynamic model. On the basis of the concept of a central role of interactions of surface waves with waves of the atmospheric boundary layer in the process of wind wave generation, a study is made of a nonviscous model of wind interaction with the laminar boundary layer in which velocity is linearly dependent on height. Within the framework of this very simple model a study is made of an elementary nonlinear process: evolution of an explosive triplet. Allowance for fourfold interactions of surface waves results in a limitation on the growth of amplitudes; the pattern of change in amplitudes has the nature of periodically repeating peaks. It is shown that the explosive generation mechanism results in a considerable broadening of the spectrum of generated (unstable) waves. A new (in comparison with the linear instability region) instability region appears in the relatively low- frequency and long-wave parts of the spectrum. Explosive instability also leads to some decrease in the threshold wind speed value. In addition, there is also a qualitative change in the nature of evolution of wave packets. Figures 2; references 19: 8 Russian, 11 Western.

Photographic Observations of Vertical Distribution of Stratospheric Ozone From 'Salyut-7' Orbital Station

18650163 Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 301 No 2, Jul 88 (manuscript received 30 Apr 88) pp 306-309

[Article by G.M. Grechko, A.S. Gurvich, N.F. Yelanskiy, V. Kan, M. Ye. Plotkin and S.A. Sitnov, Atmospheric Physics Institute, USSR Academy of Sciences, Moscow]

[Abstract] A method for retrieving mesoscale features of stratospheric ozone distribution from the coloring of the Earth's twilight aureole was proposed earlier by G.M. Grechko, et al. in DAN, Vol 271, No 1, pp 76-80, 1983. It is proposed that the accuracy of such qualitative evaluations be increased by combining aureole observations with measurements of the vertical distribution of ozone on the basis of attenuation of direct solar radiation in the ozone absorption band in the visible part of the spectrum passing through the twilight atmosphere. A photographic method is described for determining the vertical distribution of ozone and some results obtained during a joint experiment for investigation of the atmosphere on "Salyut-7" (September 1985) are presented. The rising and setting sun was photographed by a camera with an objective 8/500 mm using four interference light filters and a set of neutral light filters. Four solar disk images with a diameter of about 5 mm were formed on the film with a distance 13 mm between the centers of adjacent images. The light filters were selected in such a way that the wavelengths of two of them coincided with the absorption maximum in the Chappuis band and the wavelength of the other two were on its wings at points with identical ozone absorption coefficients. This choice of light filters made possible effective separation of the ozone and aerosol attenuation of solar radiation. A reference frame with the sun high above the horizon, when atmospheric absorption was negligible, was obtained for each sunrise or sunset. The availability of such a frame made it possible to determine atmospheric absorption. Four surveys of the rising or setting sun were made which made it possible to retrieve the vertical profiles of ozone concentration and the aerosol extinction coefficient. Procedures are proposed for eliminating certain sources of error. It was found that the ozone distribution is nonuniform vertically; the vertical profiles reveal layers of increased and reduced ozone content. The method thus makes it possible to combine research on the layered structure of the stratosphere with aureole observations. Figures 2; references 6: 2 Russian, 4 Western.

IR Thermal Radiation Fluxes Accompanying Cirrus Clouds

18650168a Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 6, Jun 88 (manuscript received 19 Mar 87) pp 586-593

[Article by Ye. M. Feygelson, Atmospheric Physics Institute, USSR Academy of Sciences]

[Abstract] The basic difficulties and sources of error in practical computation of the integral flows of thermal radiation in a cirrus cloud cover situation are examined. The microstructure, liquid water content, optical parameters and emissivity of cirrus clouds are discussed in detail. Until now computations of the optical properties of cirrus clouds have been made for the most part on the assumption of a random spatial orientation of particles. In some studies the crystals are replaced by spheres of equivalent volume. In actuality, the particles lie in randomly oriented horizontal planes, which considerably complicates radiation transfer theory. Considering the present status of experimental data, imperfection of microphysical models and inadequacy of transfer theory methods, it is difficult to formulate adequately precise methods for computing the propagation of thermal radiation in the atmosphere in the presence of cirrus clouds. For numerical climate and weather forecasting models it is more feasible and practical to parametrize the influence of cirrus clouds on the integral flows of thermal radiation within the framework of generally accepted algorithms for computing these flows. The integral emissivities and fluxes are analyzed in detail as a basis for implementing such an approach. Particular attention is given to the contribution of the gas component to the formation of emissivity and a method is proposed for taking into account the reflection of thermal radiation of the subcloud layer by a cloud. References 16: 7 Russian, 9 Western.

Retrieval of Fields of Concentration of Atmospheric Gases Using Sounding Data for Tangential Paths

18650168b Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 6, Jun 88 (manuscript received 27 Mar 87, after revision 13 Oct 87) pp 594-600

[Article by G. S. Gurevich and V. U. Khattatov, Central Aerological Observatory]

[Abstract] A new approach to problems in satellite tomography is proposed which is based on the expansion of the sought-for field of concentration of atmospheric gas into a system of approximate eigenfunctions of the corresponding integral equation. This approach, with allowance for the peculiarities of tangential sounding, gives simple and quite precise computation relations also suitable for the writing of effective algorithms for the processing of measurements and for an analytical study of the possibilities of tangential sounding. An effort was made to determine how spatial resolution and sensitivity of the solution are related to measurement errors and how corrections to the locally spherically symmetric atmosphere (LSSA) approximation are computed and what magnitude these corrections can attain under real conditions. A dependence was found between the sensitivity of the solution to measurement errors and the parameters of spatial resolution (vertical and horizontal). Applicability conditions were evaluated and LSSA corrections were computed. It is shown that these corrections can attain appreciable values for the most sharply expressed real horizontal inhomogeneities of concentration of atmospheric gases, especially in the region of the "ozone hole" over Antarctica. In contrast to known tomographic methods, the proposed approach does not require the use of high-speed computers and some problems can be solved analytically. References 10: 2 Russian, 8 Western.

Active-Passive Radar Observation of Thunderstorm Foci

18650168c Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 6, Jun 88 (manuscript received 10 Apr 85) pp 601-612

[Article by L. G. Kachurin, L. I. Divinskiy, B. D. Ivanov, Yu. G. Osipov, A. V. Belotserkovskiy and Ye. V. Osokina, Leningrad Hydrometeorological Institute]

[Abstract] Active-passive radar observations of thunderstorm foci in the meter or long-wave part of the decimeter range of wavelengths make it possible to obtain qualitatively new information on the electrical state of clouds. Radar returns received from lightning channels make it possible to obtain the coordinates of lightning (range to discharge and its azimuth), the times of its occurrence, lifetime and spatial extent. This gives reliable information on thunderstorm activity, tracing it in a radius up to 200 km, from the early stage of its development to its dissipation. Thunderstorm observations by the active radar method synchronously in the centimeter and meter ranges have shown that lightning occurs for the most part in the rear part of a cloud (relative to the direction of cloud movement) and the region of maximal occurrence of lightning (thunderstorm focus) is usually situated behind the zone of maximal reflectivity from hydrometeors, especially clearly manifested in thunderstorms associated with the passage of fronts. In the prethunderstorm stage it is possible to determine the degree of aggravation of the situation and the potential thunderstorm danger of clouds for flightcraft. On the basis of data collected at a real time scale spatial-temporal thunderstorm activity panoramas can be constructed and the tendency in development of the thunderstorm process can be precomputed. Specific examples of these possibilities are discussed. Figures 7; references: 24 Russian.

Radiophysical Research on Nonlinear Surface Waves

18650168d Moscow IZVESTIYA AKADEMII NAUK SSSR: FIZIKA ATMOSFERY I OKEANA in Russian Vol 24 No 6, Jun 88 (manuscript received 27 Mar 87) pp 640-646

[Article by V. A. Ilin, M. S. Kamenetskaya, V. Yu. Rayzer, K. Z. Fatykhov and S. R. Filonovich, Moscow State Pedagogic Institute; Space Research Institute, USSR Academy of Sciences]

[Abstract] The results of experimental and theoretical investigations of the influence of waves of finite amplitude on the thermal radio emission of a water surface are presented. The method for model radiohydrophysical measurements in an open experimental basin was described by V.A. Ilin, et al. in IZV. AN SSSR: FAO, Vol 21, No 1, pp 83-89, 1985. The new experiment described in this article was carried out with a wide-band Josephson radiometer in the wavelength range 1.5 cm. Waves were generated in a basin by oscillations of a foam plastic wedge in the vertical plane. Wave amplitude (0.2-1.5 cm) and length (10- 50 cm) were regulated by vertical movement of the wedge and the frequency of its oscillations. Scale photographs of the profiles were taken, reduced to digital form and introduced into a computer. Fourier analysis was used in discriminating the principal harmonic components and constructing line spectra of the studied disturbances. These were used in judging the spectral composition and degree of nonlinearity of waves in the basin. It is shown that the radiobrightness contrast due to the disturbances is dependent on the steepness and spectral composition of the wave. A model is outlined which takes into account the distinguishing characteristics of nonlinear surface waves and explains the brightness contrasts observed in the microwave range. Figures 4; references 7: 6 Russian, 1 Western.

Some Approaches to Regulation of Effect of Chlorofluorocarbons on Ozone Layer

18650169a Moscow METEOROLOGIYA I GIDROLOGIYA in Russian No 7, Jul 88 (manuscript received 8 Jul 87) pp 16-24

[Article by V.M. Zakharov, professor, and V.Ye. Rokotyan and V.U. Khattatov, candidates of physical and mathematical sciences, Central Aerological Observatory]

[Abstract] There is a great nonuniformity in the production and consumption of chlorofluorocarbons in different countries and there is also a great nonuniformity in the degree of satisfaction of the needs of the population in different regions. A method is proposed for calculating the socioeconomic losses associated with measures for restricting their production for preserving the environment. An important characteristic is the annual consumption of F-11 and F-12 per capita; a table of this consumption for 1980 is given. The computation scheme includes two stages. 1. Determination of limit on total content of chlorofluorocarbons in the atmosphere. A more precise physicochemical model of the ozonosphere is needed for determining the limiting admissible quantity of ozone-active atmospheric substances not leading to its irreversible transformation. The system for monitoring composition of the ozonosphere must give information on the quantities of these substances which have been accumulated. 2. Application of the equal loss principle for countries producing chlorofluorocarbons. The loss for the population of each country can be computed. Allowance must be made for the interests of the developing countries. Formulas are derived for determining the limit on the total content of atmospheric chlorofluorocarbons. With adherence to the equal loss principle it is possible to compute quotas for the production of chlorofluorocarbons and its growth. A procedure is proposed for calculating production quotas for different countries and a table gives the maximal admissible growth of production. The proposals in this article provide a sound strategy for environmental protection, giving a basis for ascertaining admissible concentrations, more precise determination of losses from measures intended to safeguard the ozone layer, for inventorying of sources and more precise determination of effluent entering the atmosphere and for organizing a system for monitoring the state of the ozone layer. References 7: 3 Russian, 4 Western.

Determining Water Reserves of Winter Clouds by Radar-Radiometric Method

18650169b Moscow METEOROLOGIYA I GIDROLOGIYA in Russian No 7, Jul 88 (manuscript received 2 Oct 87) pp 25-38

[Article by A. S. Azarov, candidate of technical sciences, N. F. Buranbayev, A. V. Koldayev, candidate of physical and mathematical sciences, and A. A. Chernikov, professor, Central Aerological Observatory]

[Abstract] A radar-radiometric outfit developed at the Central Aerological Observatory for sounding precipitation-forming clouds is described. A block diagram of this apparatus is given (22 components are identified); it serves as a basis for a detailed textual description. The outfit includes microwave radiometers operating at wavelengths 0.8 and 1.35 cm, a coherent radar operating in the 3-cm range, an automated control and registry system and a thermostabilization system. All these systems are carried in a radar station van. The radiometric apparatus includes two modulation-type superheterodyne radiometers. The radiometer antennas are directed through a window at a passive reflector mounted at an angle 45:SD to the horizon. The technical specifications of this apparatus are given in a table and the measurement method is described. The high accuracy of this apparatus and its stability of operation for the first time made it possible to carry out seasonal around-the-clock measurements of the moisture reserves of clouds in the central part of the European USSR. Observations were made during the period December 1985-February 1986. Data on the moisture reserves of winter clouds were used in determining their cumulative distributions by months and for the season as a whole. The mean seasonal moisture reserve of winter clouds was 0.11 kg/m2. In some months such clouds may exist 30 percent of the time. In virtually all types of fronts there are zones of supercooled liquid- droplet water and therefore it is possible to select regions suitable for artificial modification for the purpose of augmenting precipitation. The data make it possible to estimate the possible increase in precipitation totals. Figures 4; references 10; 8 Russian, 2 Western.